It may be interesting to note in this connection that calculations show that, neglecting the retardation of the air, it would require a muzzle velocity of only about seven miles per second to make a projectile leave the earth entirely and never return, while with a velocity of about five miles per second, only five times that reached in the German gun, the projectile would revolve around the earth as a satellite. Obviously, velocities somewhat short of these values would be sufficient to reach from any one point of the earth's surface to any other point, if the resistance of the air could be neglected. To actually accomplish the result it would be necessary only to give a sufficient added velocity to the projectile so that it might have the velocity mentioned by the time it had risen above the earth's atmosphere. Whether it will ever be possible to design a gun capable of giving such a velocity to a projectile is a problem for the future.

Factors Influencing the Teaching of Science and Engineering.

A. A. POTTER.

The following factors contribute to efficient instruction:

1. ORGANIZATION. The duties of every person connected with the administration, instruction and research activities of an educational institution should be carefully worked out, showing lines of authority and of responsibility. A diagram should then be drawn up which shows at a glance to whom each individual in the organization is responsible, and the main duties, whether executive, teaching or investigational, every person is performing. This chart should be supplemented by departmental charts and by written instructions, which should set forth details of organization.

It should be the duty of the head of the institution to familiarize the heads of the various departments with the organization. The heads of departments should be held responsible for the quality of instruction in their departments.

To correlate the work of the various instructors in any given department, frequent conferences should be held of all instructors teaching the same or related subjects. These conferences should be very informal and should aid in developing *esprit de corps* among the instructors, while improving teaching methods and bringing out defects in textbooks, schedules of assignments, subject matter, etc.

The head of the institution should also hold frequent conferences of all department heads in order to correlate the work of the various departments and to discuss administrative details. Matters affecting the entire teaching force should be discussed at general meetings, which should be attended by every person connected with the institution.

When several instructors are teaching the same subject, but to different sections, the schedule of instruction should be planned by a committee including all such instructors, and in coöperation with the head of the department. If at all possible, where several instructors are handling the same subject, the sections should be arranged so that men possessing similar qualifications are assigned to the same section. Greatest aid—that is, better teachers and smaller sections—should be set aside for those students of lesser ability who show a desire to make most of their opportunity.

Every effort should be exerted to build upon a man's ability, knowledge and experience. This means that every student is carefully tested before being assigned to any particular class, and his progress is carefully watched.

2. INSTRUCTORS. The personality, ability, education and experience of the instructors have more to do with the success of any educational institution than all other factors combined. A good instructor has a thorough knowledge of his subject, is familiar with the best teaching methods, understands human nature, and is able to interest and to enthuse his students in the subject he is teaching, while stimulating each man's imagination and developing the student's initiative.

The personal relations which exist between the instructor and his students influence the results attained. An instructor who exhibits too much superiority will prevent students from seeking guidance at a time when such assistance will do most good. An easy-going instructor will retard the development of the students' initiative and imagination.

An instructor of engineering subjects should have practical knowledge, in order that he may be in a position to distinguish the essential from the non-essential. On the other hand, a man with too much practical experience often makes a poor instructor, as he expects too much of his students, takes too much for granted, or spends too much time in imparting specialized knowledge instead of teaching or of developing such discipline of mind as will enable the student to acquire knowledge by his own efforts.

A good instructor is able to talk on his feet so that he can be heard and correctly understood, and has such human qualities as to enthuse his students in the subject he is teaching.

3. TEACHING METHODS. Failure on the part of a student to grasp a certain subject is usually laid at the door of the student. Careful observation will show that such failures can often be traced to poor teaching methods or to incompetent instructors.

The best teaching methods lay the greatest emphasis at all times upon teaching men and not subjects. Every effort should be made to build upon a student's ability, knowledge and experience, while stimulating his imagination and developing judgment and leadership.

Instruction cannot be efficient unless the student is interested in what he studies. To interest a student in his studies, such studies must be practical and must be imparted so that the student can see the application of the subject he studies. In scientific and engineering courses laboratory instruction should be so correlated to the classroom work that the student learns to do by doing. In the classroom, instruction lectures should be eliminated or reduced to a minimum, and in their place the recitation method should be used in connection with practical problems, so that principles are fixed in the student's mind.

In classroom work not more than fifteen men should be assigned to one instructor, and the instruction should be planned so that each student recites every day. To save the student's time, problems bearing upon the lesson should be written out by the instructor before the time of the class and handed to each student as he enters the classroom. The student solves the problem on the blackboard, and the instructor, by watching the student's work can find out the weak points while imparting instruction to each indi-

vidual student. Not more than one-third of the classroom time should be devoted to the solution of the problems on the blackboard, and the remainder of the time should be utilized in oral discussions. In conducting an oral recitation the instructor first asks the question before the whole class, and then calls upon one student to give the answer. This method keeps the whole class alert, which is not the case if the instructor calls upon the student and then asks him the question. It is poor practice for the instructor to keep his textbook open during a recitation, except when the students are required to do the same in order to call attention to an illustration or to a table of figures.

The subject matter should be carefully planned and well organized. The instruction process should consist of a series of steps or exercises, taken in order from the simple to the complex. Textbook or printed notes should be used in every course, and the lesson assignment should be worked out in advance and committed to writing. Copies of the lesson schedules should be given to each student or posted, so that oral directions can be reduced to a minimum, thus conserving the student's time.

Definite organization of instructional staff and of teaching material combined with superior instructors will always result in efficient instruction.

A Review of Literature on the Rusts of Oats, with Notes on Their Distribution in the United States.*

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INTRODUCTION.

Oats are not only one of the important cereals of commerce, but are largely grown and used in almost every agricultural region as a feed crop. Thus the acreage and yield per acre are of local as well as national importance. Any factor or factors which operate to reduce the yield per acre in any locality, therefore, deserve to be carefully studied, always with the object of gaining that knowledge which will be useful in improving or maintaining the yield of the crop.

The rusts of oats must be counted as limiting factors in oat production, not in all localities nor in every season, but nevertheless causing immense average annual losses. A considerable amount of work has been done in this and other countries in the attempt to increase our knowledge of these parasites and their host relationships, and thus to make possible the utilization of effective control methods.

In connection with the writer's work on the problem of rust resistance in oats it seemed desirable to assemble the literature not only of that particular problem, but of the various other phases of experimental work on the oat rusts. This summary of the important literature should be of interest to

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